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FIFTH UNITED NATIONS REGIONAL
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THE AMERICAS
New York, 11-15 January 1993
Item 6 (a) of the provisional agenda*

REVIEW OF THE LATEST DEVELOPMENTS RELATING TO POLICIES AND MANAGEMENT OF NATIONAL MAPPING AND CHARTING PROGRAMMES

MANAGERIAL AND TECHNICAL ASPECTS OF NATIONAL DEVELOPMENT PROGRAMMES

The International Federation of Surveyors (FIG) and its four-year work plan for the period 1992-1995

Paper submitted by International Federation of Surveyors (FIG)**

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The location of the administration of FIG moves every four years to the country in which its next Congress is to be held. The majority of the members of its administrative Bureau come from that country and the Bureau will be resident in Australia for the quadrennium 1992-1995.

These four year changes provide convenient time periods at which to review the objectives and strategies of the Federation. Each Bureau has, in recent years,prepared a Work Plan which sets out these future directions for the period ahead.

The Australian Bureau has produced its Work Plan and a major emphasis is on assisting developing countries in their efforts towards land and marine management, development and conservation, in the search for a future built upon policies and practices sustainable in the long term.

The paper outlines the approaches and mechanisms to be followed by FIG in the period ahead.

The Surveyor and Global Change

FIG has accepted the theme of "The Surveyor and Global Change" for the four year term of the Australian Bureau. That our fragile and constantly evolving planet is undergoing profound change is axiomatic. Some of these changes are caused by the agency of mankind while others are from so called "natural causes" and links between the two can be complex and sometimes not easily discerned.

The United Nations Conference on Environment and Development in June 1992 produced some startling statistics which highlight the diversity and rapidity of those changes.

- the world's population, now 5.3 billion is likely to double in the next 40 years.
- 10% of the world's potentially fertile land has been turned to waste by human interference.
- over 20 million hectares of tropical forests are being cut down each year.
- about 1.3 billion people have access only to polluted water, 2.3 billion lack sanitation facilities and 1.5 billion lack sufficient fuel for cooking and heating.
- less than 25% of the world's population lives in industrialised countries yet they consume 75% of the world's energy, 72% of steel production and 85% of all wood products. (1)

The simple statement of these facts speaks eloquently of the problems which the whole world faces.

The Surveyor's Work

The recently approved FIG definition of a surveyor states that a surveyor possesses qualifications and expertise to practise the science of measurement, to assemble and assess land information, to use it for planning and implementing the efficient administration of the land, the sea and structures on and in them and to instigate the advancement and development of these practices.(2)

As a consequence of accepting and applying that definition,
FIG believes that the work of surveyors in all fields and applications is central to countries being able to manage their land and marine resources in ways which enhance the life of all people and so assist in coping with global change to the greatest extent possible.
Whilst technology itself will provide important tools, FIG believes that the development of people is of at least equal importance. Thus much of the Work Plan is directed towards activities which will provide surveyors across the world with development opportunities, events which will assist in the increase of

knowledge and understanding and enable those participating to cope better with the complexities of their immediate environment.

Primary Objectives.

Core elements of the Work Plan which deal with these "people oriented" issues include:

- the strengthening of ties within the international community,
- consolidating regional co-operation between members of the profession especially, but not by any means exclusively, in the Asia/Pacific Region,
- facilitating the work of FIG's nine Technical and Scientific Commissions in less developed countries,
- convening the 1994 FIG Congress in Melbourne, Australia on the theme "Surveying Global Changes",
- implementing the land management and environmental policies of FIG and its Commissions, emphasising the importance of sustainable development and its relationship to equitable urban and regional development,
- fostering liaison and closer ties with relevant United Nations organisations and agencies.
- investigating how FIG's policies on the exchange of surveying personnel can best be implemented.
- producing a series of succinct publications aimed at providing surveyors with advice and information which will be of benefit to them.

How to do it ?

Sir Kenneth Clarke observed that "fine words butter no parsnips!"(3) It is not sufficient to merely set out objectives in high sounding words but it is essential to follow them through with actions which meet the objectives. The Bureau has thought through the actions it needs to initiate and these include the following:

- each of the nine FIG Commissions has been requested to hold a workshop or symposium in a developing country during the quadrennium. At this early stage it is encouraging to have opportunities emerging in the African, South American and Asian continents.
- the emerging countries of Asia and the Pacific have expressed the need to provide development opportunities for their surveyors. Actions have already commenced to identify how, through membership in FIG, surveyors in these countries can be exposed to international thought and discussion and bring benefits to their own countries.Encouragement is also being given to facilitating exchange programs, allowing surveyors from these countries to gain experience elsewhere.
- a need in many parts of the developing world and in those countries in eastern and central Europe now experiencing greater political freedom and diversity, is for secure, registered and inviolate land tenure for their people and especially but not exclusively for those involved in agriculture and food production. Experience has clearly shown how, in many parts of the world,

the lack of security of tenure of agricultural land has adversely affected that country's ability to provide a sustainable and acceptable standard of living for its people. Surveyors have a key role in putting in place and maintaining the records of land information which support an efficient and modern system of tenured land. FIG has requested its relevant Commission to produce a succinct "Statement on the Cadastre". The publication will be non-technical and primarily designed to assist governments, policy makers and land administrators understand better how a sound, efficient and relevant cadastral system can provide benefits to countries seeking to improve the ability of its citizens to be involved in development and improved productivity.

Essential Partnerships

FIG recognises that it does not and should not work in isolation in addressing these vital issues which affect so many individuals and countries. Nor does it have the resources to be able to do so. Consequently FIG is seeking to work in partnership or co-operation with kindred professional associations where, for example, a multi-disciplinary approach would enhance the dissemination of valuable knowledge.
Similarly, FIG does not have the financial resources within itself to be able to ensure that the proposed workshops and symposia in developing countries reach the maximum number of participants. By working in close co-operation and consultation with the United Nations and its agencies, FIG hopes to receive that measure of support which will maximise the benefit of development opportunities for surveyors from those countries where the need is greatest.
The essential elements necessary for holding a successful workshop in a developing country can include:

- identifying a host country and an association within it able to host the activity,
- identifying a sponsor country or countries ready to provide organisational support, expertise and backing,and
- having financial support available to enable people from the country and surrounding countries of the Region to attend and benefit from the interaction.

FIG recognises that there are other approaches possible for the holding of these meetings and will be pursuing all avenues open to it.

Conclusion

The Australian FIG Bureau has been told that it is responsible for the administration of FIG affairs at one of the most important periods of change in modern history. The realities and consequences of those change processes provide both opportunities and challenges for FIG and for surveyors world-wide. It has developed a Work Plan for the next four years which focusses heavily on the needs of developing countries, the places where conditions are most affected, either positively or negatively, by incremental change and where

surveyors can make an important contribution to the welfare of the citizens of those countries.
To achieve its objectives will require the development of partnerships with others and support from those sympathetic to the creation of
health and fulfillment for all people.

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(2). FIG Publication, (1991), Definition of a Surveyor.

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Item 5 (j) of the provisional agenda*

REVIEW OF THE LATEST DEVELOPMENTS RELATING TO POLICIES AND MANAGEMENT OF NATIONAL MAPPING AND CHARTING PROGRAMMES:

AUTOMATIC CARTOGRAPHY: DEVELOPMENT AND APPLICATION OF DIGITAL CARTOGRAPHIC DATABASES, INCLUDING DIGITAL TERRAIN MODELLING

Development of the Topographic Data System in Finland

Paper submitted by Finland**

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** Prepared by the National Land Survey of Finland.

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Introduction

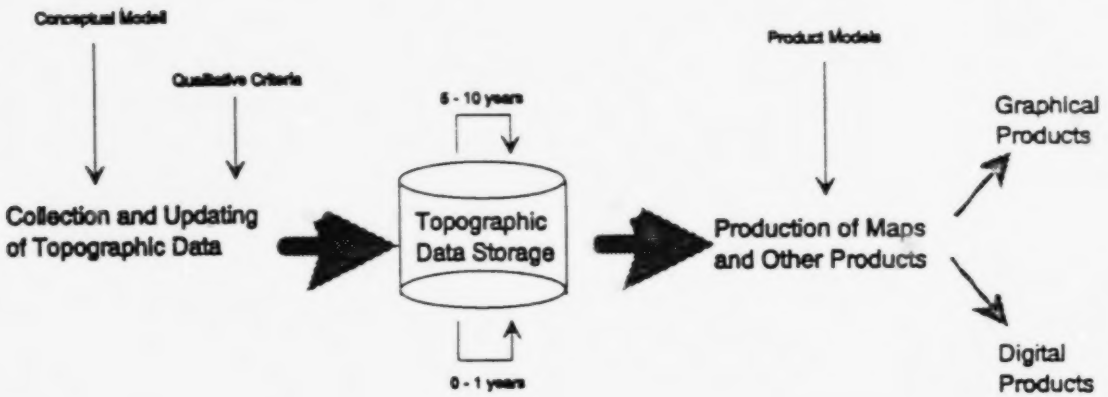
Key mapping assignments of recent decades have included the measurement of national control points and the basic mapping of Finland. Since the first round of basic mapping was completed in the 1970s, the Basic Map Series has been continually updated. Most of this work has been carried out using long-established methods, although computers have been used since the 1970s to automate certain stages of production, such as fair drawing.

Since the late '80s the National Land Survey has comprehensively upgraded its methods of topographic map production. In 1987 and 1988 planning was carried out for a new, more generalized 1:50,000 topographic map, which has been under computerized production since 1989. In 1991 a project was launched to upgrade methods of producing the 1:5,000 - 1:20,000 Basic Map, the results of which have been put into production in 1992.

The aim in modernizing the production of topographic maps is to create a topographic data system which will enhance the flexibility of the present mass production-based system. In addition to producing conventional printed and copied maps, the topographic data system creates opportunities for a whole new range of products carefully tailored to the customers' needs.

Topographic data system

The system is designed for gathering and updating topographic data and for producing maps and other material.



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The collection and updating of topographic data

The collection and updating of topographic data revolves around a network of permanent control points; about 1,000 new triangulation points and 1,200 elevation bench marks are measured yearly.

A new system has been adopted for surveying horizontal control points: the Global Positioning System (GPS). All data are now processed automatically, from the reception of satellite data to transferral of the measured coordinates to other systems.

Automated levelling equipment and topographic data recorders have revolutionized the process of measuring elevation bench marks.

According to current production plans for topographic maps, aerially photographed terrain annually accounts for an area of about 20,000 km2 at a reproduction scale of 1:16,000, and about 30,000 km2 at a scale of 1:31,000. Auxiliary control points for stereoplotting are obtained using photogrammetric control densification, where exact coordinates are calculated for the signalled cadastral boundary marks.

Topographic data on roads, buildings, fields, bodies of water and powerlines are obtained using a stereoplotter. With some terrain, stereoplotters are also used in the plotting of contours to achieve a higher level of accuracy. Supplementary topographic data obtained from existing maps or copied from registers or other indexes are then digitized. These data are topologically and cartographically integrated with those obtained using the stereoplotter.

All topographic data in graphic-mode Basic Maps can be digitized, provided that the control points and mapping procedures conform to the current quality standards required of topographic data.

Terrain which cannot be interpreted with the aid of aerial photographs or other sources is surveyed on site.

The procedure for collecting and updating topographic data complies with a set of guidelines drawn up on the basis of the conceptual model and its qualitative criteria. The conceptual model defines the different features of terrain to be included in the topographic database, while the qualitative criteria define the standards of topographic data gathered and updated for those features of terrain. The guidelines then determine how the information on those classes of terrain is to be interpreted and how it is to be collected from different sources.

Information on traffic networks, buildings and powerlines is updated every year or more. Information from other authorities is taken into account as extensively as possible when these entries are updated. High altitude photography is used as a further source of reference. Entries thus revised are kept up-to-date, although their level of geographical precision is inferior to that of terrain which has been stereoplotted. For optimum accuracy, regional mapping based on aerial photography is carried out every 5-10 years.

Over the next ten years, the aim is to compile all topographical data complying with the conceptual models and qualitative criteria into the topographical database. In effect, this means that 40,000 km2 will be mapped each year. Certain sites, such as roads, water areas, fields and contours, have been digitized on an expedited schedule. This information will be copied from the 1:20,000 Basic Map of Finland and digitized in full by the end of 1993.

The task of collecting and updating topographic data is divided between the National Land Survey's 11 mapping and data service offices.

Topographic database

The National Land Survey's topographic database is a national, topologically and cartographically integrated, up-to-date, topographical index that is the most geographically accurate of its kind. The database forms a core part of Finland's geographical information system.

The following data are recorded in the topographic database:
- traffic networks;
- buildings;
- powerlines;
- terrain features;
- bodies of water;
- elevation;
- special regulations;
- conservation sites;
- administrative boundaries;
- cadastral structure; and
- control points.

The conceptual model defines the topographic data to be recorded for the site in question. These include the site's class of terrain, geometrical depiction and level of geographical accuracy, its code for joint access with other data systems and an abridged attributes on its specific characteristics.

Finland measures 338,000 km2 in area. It is estimated that the topographic database will eventually contain 53 gigabytes. The database is currently distributed between the National Land Survey's mapping and data service offices.

Database products

The production of maps and other products is chiefly based on the information collected and updated for the topographic database.

The printed editions of the 1:20,000 Basic Map and the 1:50,000 topographic map are compiled from information in the topographic database using automated, interactive techniques. A map publishing system is used to produce printing films. New cartographic products are brought out in line with technological innovation and customer demand.

Other printed products compiled from information in the database are produced using a range of plotters.

Demand for topographic data in digital format is constantly on the increase. The specific data required by the customer can be singled out from the database. If required, they can then be combined with geographical information produced elsewhere and tailored to suit the customer's needs. A special effort is made to keep the production of digital products as flexible as possible so as to ensure that they meet the customer's needs exactly.

Geometrical data for Finland's roadways are copied from the distributed topographic database into a centralized service database on roadways, which can likewise be used to produce a new range of products. A national roadway database will be set up by the end of 1993.

All graphic-mode 1:20,000 topographic maps are to be converted to numerical raster format by the end of 1993. This quick response to growing demand for digital data also provides an opportunity to augment the product range.

Product specifications are documented in the product models.

Development of the topographic data system

The topographic data system has been developed around established production methods: that of the 1:10,000/1:20,000 Basic Maps and the 1:50,000 topographic maps and the MAAGIS geographical information system created by the National Land Survey of Finland. The objective has been to implement a step-by-step strategy in the development of production structures for topographic maps, whereby a minimal amount of time is spent developing the method before it is brought on stream.

Schedule for the development of the topographic data system:

	1987	1988	1989	1990	1991	1992	1993	1994	1995
Topographic map 1:50,000			**********	**********					
Basic Map 1:5,000-1:20,000					**********	**********			
Intergration of the systems						**********	**********		
Development of database products					**********	**********	**********		

Form and content of the 1:50,000 topographic map was defined in 1987 and 1988. A computerized production method was introduced in 1989-1991. Map production was launched in 1989, and the fine-tuning of the system was carried out while production was under way.

Form and content of the 1:5,000 - 1:20,000 Basic Map was defined in 1991 and 1992. A system was concurrently set up to comprise all stages of production from the collection of topographic data and the compilation of printed editions, right up to the distribution of digital data. The system was integrated in the National Land Survey's decentralized production infrastructure in 1992.

The next step is the interfacing of the two systems (that of the 1;50,000 topographic map and the 1:5000 - 1:20,000 Basic Map) to avoid overlaps in entering the bulk of the information into the database. Maps and digital products are accessed from the topographic database and then further refined.

The system was further improved in 1992 with the introduction of a new map publishing system and a new commercial GIS system used for setting up service databases.

Modernization of the topographic data system is imperative if the National Land Survey is to keep up with continuing advances in information technology and the opportunities its comprehensive use offers. Up-to-date, digital topographic data represent a growing focus of mapping and its product range.

The new topographic data system will hopefully improve the productivity and cost-effectiveness of mapping operations by up to several dozen per cent.